Unit and Title of Lesson: Grade 11 Biology – Evolution: Environment Stresses and Change

Curriculum Connections

Materials	Include in Appendix
❑ Computer ❑ Projector ❑ Internet ❑ Candy treats ❑ Speakers ❑ Cue Cards	❑ Appendix A: Instructions for Jigsaw Activity ❑ Appendix B: Instructions for "Who Wants to Live a Million Years"

Big Ideas

- Evolution is the process of biological change over time based on the relationships between species and their environments.
- The theory of evolution is a scientific explanation based on a large accumulation of evidence.
- Technology that enables humans to manipulate the development of species has economic and environmental implications.

Ministry Expectations - Overall Expectations

C1. Analyse the economic and environmental advantages and disadvantages of an artificial selection technology, and evaluate the impact of environmental changes on natural selection and endangered species.

C2. Investigate evolutionary processes, and analyse scientific evidence that supports the theory of evolution.

C3. Demonstrate an understanding of the theory of evolution, the evidence that supports it, and some of the mechanisms by which it occurs.

Ministry Expectations - Specific Expectations

C1.2 Evaluate the possible impact of an environmental change on natural selection and on the vulnerability of species (e.g., adaptation to environmental changes can affect reproductive success of an organism) [AI, C]

C2.1 Use appropriate terminology related to evolution, including, but not limited to: *extinction, natural selection, phylogeny, speciation, niche, mutation, mimicry, adaptation,* and *survival of the fittest* [C]

C3.2 Explain the process of adaptation of individual organisms to their environment (e.g., some disease-causing bacteria in a bacterial population can survive exposure to antibiotics due to slight genetic variations from the rest of the population, which allows successful surviving bacteria to pass on antibiotic resistance to the next generation)

Learning Goals

- To understand the impact of environmental change on natural selection for an imaginary species
- To introduce key terms like adaptation, mutation, natural selection, survival of the fittest and extinction in a fun and visual manner
- To evaluate the impact of climate change on the survival of different species

Prior Knowledge

- Sustainable Ecosystems (Grade 9 Science)
- History and the theory of evolution
- Natural selection, sexual selection, artificial selection
- Genetic variation
- Genetic drift

Time: 15 minutes	**Before: Minds On**	**A. Adaptation Jigsaw Activity**
		See Appendix A
		• Divide the students into groups of four
		• Provide each group with an environmental change and ask them to brainstorm what adaptations are needed to deal with that change
		  ○ Cold weather
		  ○ Hot weather
		  ○ Predators
		  ○ Food on tall trees
		  ○ Drought
		  ○ Volcano eruption
		• Ask the class to share their answers
		See Appendix A
		
		B. Computer Game: "Who Wants to Live a Million Years?"
		See Appendix B
		• Briefly explain the rules of the game
		• Allow each group to come to the board to play the game
		• Award the group that can survive a million years with candy treats
			Rationale for choice of T/L Strategy:
			• To assess the student's prior knowledge of adaptation to environmental changes
			• To allow gradual recall of information with peers in their groups
			• To allow sharing of the information with the class
			• To enact the responses via a computer-game simulation
			• To assess the student's strategies to help their species survive a million years
			• To direct the student's attention to the lesson and to help them make connections
				Assessment Strategies: A. Answers to the adaptation jigsaw activity; B. Participation in the computer game and answers to discussion questions

Appendix A: Adaptation Jigsaw Activity (Teacher Notes)

1) Divide the class into groups of four students.

2) Provide each group with a cue card that has an environmental change on it.
Example:

Cold Weather	**Hot Weather**	**Predators**
1)	**1)**	**1)**
2)	**2)**	**2)**
3)	**3)**	**3)**
Food on Tall Trees	**Drought**	**Volcanic Eruption**
1)	**1)**	**1)**
2)	**2)**	**2)**
3)	**3)**	**3)**

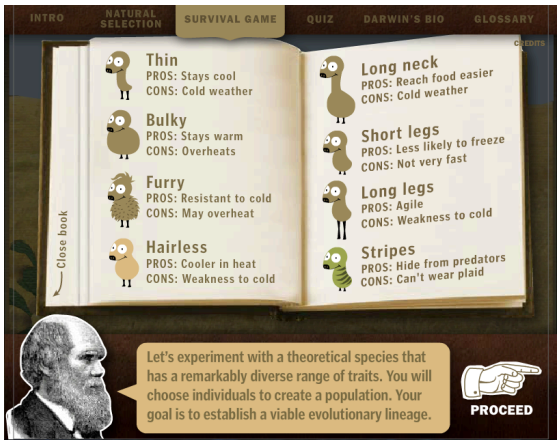
3) Ask the groups to brainstorm and come up with a minimum of three adaptations to deal with the environmental change. *NOTE: Be sure to emphasize that the adaptations arise because the species that are able to survive pass on their characteristics to their offspring (Darwin's theory). Adaptations do not occur during a lifespan of the species (Lamarck's theory).

4) Ask the groups to present their environmental change and the adaptations they came up with.

Appendix B: Computer Game – "Who Wants to Live a Million Years?" (Teacher Notes)

1) Connect the computer to the SMARTboard and access the internet: http://science.discovery.com/interactives/literacy/darwin/media/darwin.swf

2) Click on "Play the Survival Game" and introduce the rules of the game.



3) Ask groups of students to come to the board and choose adaptations in genetic mutations to help their species survive a million years.

4) Groups that survive win a candy treat!

5) Follow-up Questions:
   a. What strategy did you use to pick the first three organisms to ensure survival?
   b. If the background changed to a red colour, what adaptations would your organisms make?